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Contribution of the University of Burdwan and Kalyani University during 2000-19: A Scientometrics analysis

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Abstract

The present paper attempt to compare the contribution of two state universities of West Bengal i.e. University of Burdwan (BU) and University of Kalyani (KU) under different parameters like publication size, authorship pattern, degree of collaboration, subject, language, geographical distribution during the period 2000 to 2019 (20 years) by using Web of Science as a source database. The study revealed that both the universities have almost similar authorship pattern, citation distribution and prefer to publish articles in journals. The USA ranked top as the most favorite country for collaboration for both the universities.

Keywords: Burdwan University, Kalyani University, scientometric analysis, bibliometric analysis, authorship pattern, quantitative analysis

Introduction:

As a university is a nodal center for research and education. It is important to evaluate the research output of any universities so that the universities try to improve their research work in terms of quantity as well as quality. In West Bengal there are 26 (twenty six) state universities (as per the UGC). For the present study two universities i.e. University of Burdwan and University of Kalyani have been taken.

As both the universities were established in the year 1960. No study has been found to compare and evaluate the research activities of two state universities of West Bengal.

Brief description of University of Burdwan and University of Kalyani:

The University of Burdwan is a state university situated in Purba Bardhaman, West Bengal. It was established on 15th June 1960. All the colleges of Birbhum, Purba Baradhaman and Hooghly district except Serampore subdivision under the Burdwan university. The university offers more than 30 undergraduate and 66 postgraduate courses and 189 affiliated colleges. Over the year Burdwan University broke into Sidho Kanho University for Purulia District, Bankura University for Bankura district and Kazi

Nazrul University for Asansol and Durgapur. As per the National Institutional Ranking Framework (NIRF) in 2020, Burdwan University rank 92nd among the different universities in India.

The University of Kalyani is also a state university situated in Nadia district of West Bengal. It was established in 1960. It offers different programmes for undergraduate and postgraduate courses. There are 44 affiliated colleges under the Kalyani university. As per the NIRF 2020, university was ranked 89th among universities in India.

Literature review:

Numerous studies have been done regarding to find out the research output of the various institutions/universities.

Balasubramani R (2014) this study analysis of publication output, authorship pattern, publication pattern of the BHU. The study reveals that there was gradual growth of publications during 2000-11 by using WoS as a source database. The study found that the majority of papers are from multi authored and current science is one of the most preferred journals among BHU researchers.

Bid S (2016) evaluated the research output of IIT kharagpur for the period 2000 to 2015 by taking scopus as a source database. The paper reveals that the growth rate of publication shows steady and papers become double in 9 years and tripled in next 3 years. The study also shows that journal is the most preferred form in which the researcher published their paper. Engineering, material science, computer science, physics and astronomy are the most favorite areas of research.

Gupta et al. (2013) evaluated the comparative study of research contributions of Karnataka University with university of Mysore, Mangalore university and Bangalore University for the year 1999-2008. Data was downloaded from Scopus database. In this study, to identify year wise distribution of papers, international collaboration , author productivity, pattern of research communications of the four universities .

Parameswaran (2015) has examined the research output of Anna University for the period 1980-2013 and data was collected from WoS as a source database. The study found that gradual growth in publications and average research output was 67 records. Journal of Crystal Growth is one of the most preferred journals .

Patel Vimlesh (2017) analyzed the research productivity of National Institute of Technology , kurukshetra during 2012-16 as indexed in Web of Science and found that authors preferred to publish their papers in conference proceeding , engineering , computer science and energy fuels are the most highly productive subject area

Siwach,A and Kumar S (2015) examined research contributions of Maharshi Dayanand University , Rohtak during 2000-2013 as reflected through Scopus database and found that average citation per paper (ACPP) is 5.58. The study also reveals that chemistry and allied disciplines are the subject where the

authors published more articles and Indian Journal of Heterocyclic Chemistry is one of the most preferred journals.

Teli Soumen and Bidyarthi (2016) the paper evaluated the research output of Vidyasagar University for the period 1989 to 2014 and analyzed different parameters like year wise growing literature , publishing trend , authorship patterns , international collaboration .

Objectives:

The main objectives of the paper are

1. To examine year wise distribution of publication of Burdwan University and Kalyani University;
2. To find out the top funding agency for BU and KU;
3. To find out citation patterns and highly cited papers;
4. To study the authorship pattern and degree of collaboration of two universities;
5. To find out the geographical distribution;
6. To identify the top collaborating institutions with BU and KU; and
7. To identify top subject wise distribution of publications

Methodology:

The study aims to find out the contribution of two universities of West Bengal for the 20 years period on the basis of data retrieved from Web of Science database (WoS), Clarivate Analytics company. The basic data from University of Burdwan and University of Kalyani for the period 2000-2019 were collected through this basic search (Organization enhanced = University of Burdwan and time period 2000-19). Same query for collecting the data for Kalyani university (Organization enhanced = Kalyani University and time period 2000-19). For the analysis and finding purposes the data can be saved in text files and then imported into Microsoft- Excel for analysis. The collected data will be evaluated and analyzed. Citation counts received by the papers which were published and available in the database have been used as qualitative measures.

Data analysis and discussion

Publication growth

Table 1 : Year-wise Distribution of Publication with Citation (University of Burdwan & University of Kalyani)

Sl. No.	Years	Records		% of Records		Sum of the Times Cited		Average Citations per Item		h-index	
		BU	KU	% of 2985	% of 3074	BU	KU	BU	KU	BU	KU
1	2000	55	53	1.84	1.72	833	936	15.15	17.66	16	16
2	2001	77	58	2.58	1.88	1,529	874	19.86	15.07	23	16
3	2002	78	89	2.61	2.89	1,228	1,142	15.74	12.83	19	18
4	2003	73	91	2.44	2.96	1,336	2,871	18.3	31.55	23	25
5	2004	93	85	3.11	2.76	1,836	2,174	19.74	25.58	24	19
6	2005	126	90	4.22	2.92	2,572	1,498	20.41	16.64	25	22
7	2006	104	112	3.48	3.64	1,819	1,705	17.49	15.22	22	23
8	2007	101	116	3.38	3.77	2,633	2,113	26.07	18.22	27	25
9	2008	103	143	3.45	4.65	1,753	2,701	17.02	18.89	23	28
10	2009	118	161	3.95	5.23	2,567	2,538	21.75	15.76	26	28
11	2010	154	173	5.15	5.62	2,845	2,681	18.47	15.5	26	27
12	2011	182	172	6.09	5.59	3,115	2,859	17.12	16.62	28	29
13	2012	192	169	6.43	5.49	3,606	2,721	18.78	16.1	30	29
14	2013	221	234	7.40	7.61	3,672	3,302	16.62	14.11	30	26
15	2014	236	236	7.90	7.67	2,585	3,647	10.95	15.45	26	29
16	2015	242	198	8.10	6.44	2,826	2,270	11.68	11.46	25	23
17	2016	179	213	5.99	6.92	1,790	1,875	10	8.8	22	22
18	2017	211	220	7.06	7.15	1,405	1,401	6.66	6.37	17	15
19	2018	201	215	6.73	6.99	1,045	1,103	5.2	5.13	14	15
20	2019	239	246	8.00	8.00	478	517	2	2.21	9	10
	Total	2985	3074								

The Burdwan university has published 2985 papers during the year 2000-19 and the average number of papers per year is 149 whereas Kalyani university has published 3074 papers during the year 2000-19 and the average number of papers per year is 158. From table 1 it is clear that for BU, in 2000 which is the initial period of the study, 55 papers published while in 2019 , 239 papers have been found. From the table it has been found that the highest number of papers published from BU in 2015with 242 papers followed by 2019 with 239 papers, 2014 with 236 papers, 2017 with 211 papers and so on. In the case of KU, 53 papers published in 2000 while in 2019 , 246 papers have been found. The highest number of papers published from KU in 2019 with 246 papers followed by 2014 with 236 papers, 2013 with 234 papers, 2017 with 220 papers and so on.

The total number of citations per article for the last 20 years of BU & KU is also shown in the **table 1**, which varies from 2 to 21.75 for BU and 2.21 to 31.55 for KU. For 2985 papers of BU received 41405 citations i.e. 13.87 average citation per paper and for 3074 papers of KU received 40895 citations i.e. 13.30 average citation per paper.

Table 2 Quadruple Publication Output (2000-2019) of University of Burdwan & University of Kalyani

Year	Paper		Quadruple Growth Rate, %	
	BU	KU	BU	KU
2000-03	283	291		
2004-07	424	403	49.82	38.48
2008-11	557	649	31.36	61.04
2012-15	891	837	59.96	28.96
2016-19	830	894	-6.84	6.81

From table 2, quadruple publications output by Burdwan University authors published 283 papers in 2000-03, 424 papers in 2004-07, 557 papers in 2008-11, 891 in 2012-15 and 830 papers in 2016-19. Thus the publications growth has been 49.82 for the quadruple period 2000-03 to 2004-07. Which gradually decreased to 31.36 for the period 2004-07 to 2008-11 again it suddenly shows an increasing trend with 59.96 for the period 2008-11 to 2012-15. It has been noticed that for the period 2012-15 to 2016-19, it shows a negative trend.

From the above table, quadruple publications output by Kalyani University authors published 291 papers in 2000-03, 403 papers in 2004-07, 649 papers in 2008-11, 837 in 2012-15 and 894 papers in 2016-19.Thus the publications growth has been 38.48 for the quadruple period 2000-03 to 2004-07. Which increased to 61.04 for the period 2004-07 to 2008-11 again it suddenly shows a decreasing trend with 28.96 for the period 2008-11 to 2012-15. It has been noticed that for the period 2012-15 to 2016-19, it shows minimum growth rate.

Document type:

Table 3: Types of publication

Document Type	Records of BU	Records of KU
Article	2864 (95.94)	2911 (94.69)
Correction	15 (0.50)	18 (0.58)
Editorial material	16 (0.53)	14 (0.45)
meeting abstract	13 (0.43)	21 (0.68)
Proceeding papers	27 (0.90)	45 (1.46)
Review	68 (2.27)	97 (3.15)

The papers published by the authors of BU and KU publish in different types of documents. Both the universities have almost similar trend of publishing and authors preferred to publish papers in journal, proceeding papers, review as shown in the table 3

Funding agencies for BU and KU:

Table 4: Top 10 funding agencies for BU and KU

Funding Agencies for BU	Sponsored Papers	Funding Agencies for KU	Sponsored Papers
University Grants Commission India	564(18.89)	Department of Science Technology India	628(20.42)
Department of Science Technology India	478(16.01)	Council of Scientific Industrial Research CSIR India	585(19.03)
Council of Scientific Industrial Research CSIR India	431(14.43)	University Grants Commission India	464(15.09)
University of Burdwan	59(1.97)	University of Kalyani	180(5.85)
Department of Atomic Energy DAE	38(1.27)	Department of Biotechnology DBT India	66(2.14)
Department of Biotechnology DBT India	25(0.83)	Department of Atomic Energy DAE	39(1.26)
National Science Council of Taiwan	22(0.73)	DST Purse	34(1.10)
Spanish Government	22(0.73)	Indian Council of Medical Research ICMR	32(1.04)
Ministry of Education Universities and Research MIUR	16(0.53)	Department of Science and Technology DST SERB	26(0.84)

Bogazici University	14(0.46)	Board of Research In Nuclear Sciences BRNS	24(0.78)

Table 4 shows the top 10 funding agencies for BU and KU. Maximum numbers of funding for both the universities come from UGC, DST, CSIR, DAE. It is also noticed that out of top10 funding agencies for BU, 4 funding agencies are from different countries like Taiwan, Spain, Italy and Turkey while in case of KU all the top 10 funding agencies are from India. Above table also shows that BU funded only 59 (1.97) papers while in case of KU, funding 180 (5.85) papers. It shows that KU funded more on research and development self financed where BU has been funded by the other countries also.

Citation Profile & highly Cited papers:

Table 5 Citation distribution of BU & KU

Times Cited	**Number of papers**		**% of BU 2985**	**% of KU 3074**
	BU	**KU**		
Zero Citation	307	341	10.28	11.09
1	271	242	9.07	7.87
2	243	225	8.14	7.31
3	183	213	6.13	6.92
4	183	176	6.13	5.72
5	155	146	5.19	4.74
6--10	579	605	19.39	19.68
11--50	923	1011	30.92	32.88
51-100	98	81	3.28	2.63
101-150	24	20	0.80	0.65
151-200	7	10	0.23	0.32
201-250	8	2	0.26	0.06
251-300	1	0	0.03	0
>300	3	2	0.10	0.06
Total	2985	3074	100	100

In case of BU, table 5 shows that 307 papers received zero citation, 271 papers received one citation, 243 papers received two citations, 183 papers received 3 citations, 183 papers received 4 citations, 155 papers received 5 citation, 579 papers in citation range 6-10, 923 papers in citation range 11-50, for more than 100 citations are received by 31 papers, more than 200 citations are received by 9 papers and more than 300 citations r received only by 3 papers. Top 5 highly cited papers of Burdwan University.

- Abbon P, Albrecht E, Alexakhin V. Yu., et al. The Compass experiment at CERN. *Nuclear Instruments & Methods In Physics Research Section A-Accelerators Spectrometers Detectors And Associated Equipment.*2007; 577(3) : 455-518p.(Times cited :384)

- Saha Bidyut, Orvig Chris. Biosorbents for hexavalent chromium elimination from industrial and municipal effluents. *Coordination Chemistry Reviews.*2010; 254(23-24):2959-2972p. (Times cited :335)

- Alexakhin VY, Alexandrov Y, Alexeev GD. et. al. First measurement of the transverse spin asymmetries of the deuteron in semi-inclusive deep inelastic scattering. *Physical Review Letters.*2005; 94(20)(Times cited :327)

- Saha Rumpa, Nandi Rumki, Saha Bidyut. Sources and toxicity of hexavalent chromium. *Journal of Coordination Chemistr.*2011; 64(10): 1782-1806p. (Times cited : 260)

- Alexakhin V. Yu., Alexandrov Yu, Alexeev, G. D., et al. The deuteron spin-dependent structure function g(1)(d) and its first moment. *Physics Letters.* 2007; 647 (1):8-17p.(Times cited:243)

In case of KU, table 5 shows that 341 papers received zero citation, 242 papers received one citation, 225 papers received two citations, 213 papers received 3 citations, 176 papers received 4 citations, 146 papers received 5 citation, 605 papers in citation range 6-10, 1011 papers in citation range 11-50, for more than 100 citations are received by 30 papers, more than 200 citations are received by 2 papers and more than 300 citations r received only by 2 papers. Top 5 highly cited papers of kalyani University

- Chakraborti S, Mandal M, Das, S. et al. Regulation of matrix metalloproteinases: An overview. *Molecular And Cellular Biochemistry.* 2003; 253 (1-2): 269-285p. (Times cited : 855)

- Islam FS, Gault AG, Boothman C. et al. Role of metal-reducing bacteria in arsenic release from Bengal delta sediments. *Nature.*2004; 430 (6995): 68-71p. (Times cited: 811)

- Paul, S; Bhattacharya, RN. Causality between energy consumption and economic growth in India: a note on conflicting results. *Energy Economics*.2004; 26 (6): 977-983p (Times cited : 222)

- Chatterjee Arijit Kumar, Chakraborty Ruchira, Basu Tarakdas. Mechanism of antibacterial activity of copper nanoparticles. *Nanotechnology*. 2014; 25(13) (Times cited : 216)

- Chatterjee, Soumya; Kundu, Subhadip; Bhattacharyya, Arindam et al. The ruthenium(II)-arene compound RAPTA-C induces apoptosis in EAC cells through mitochondrial and p53-JNK pathways. *Journal Of Biological Inorganic Chemistry*. 2008; 13 (7): 1149-1155p. (Times cited: 196)

Authors Pattern

Table 6 Authorship Pattern of Papers Published Burdwan University

Year	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Ten>	Total	%
2000	2	14	19	10	5	5						55	1.84
2001	2	13	28	15	14	3	1	1				77	2.57
2002	4	16	22	12	13	9	2					78	2.61
2003	2	17	21	13	14	3	1	1	1			73	2.44
2004	5	23	19	10	20	9	3	2			2	93	3.11
2005	9	30	25	29	13	10	3	2	1		4	126	4.22
2006	6	25	26	20	14	4	4	1	1	1	2	104	3.48
2007	3	21	28	22	8	5	6		1		7	101	3.38
2008	7	27	30	12	13	8	3		2		1	103	3.45
2009	6	39	28	18	10	6	4	1	1		5	118	3.95
2010	5	38	38	23	25	15	6	3	1			154	5.15
2011	7	52	39	22	20	28	9		3	1	1	182	6.09
2012	8	50	37	17	27	26	18	6	2		1	192	6.43
2013	9	42	54	19	20	29	26	11	3	4	4	221	7.4
2014	6	46	65	34	19	32	18	11	4	1		236	7.9
2015	9	46	59	36	41	19	11	7	7	2	5	242	8.1
2016	3	32	42	34	28	12	11	8	4	2	3	179	5.99
2017	9	38	48	40	30	15	21	5	3	1	1	211	7.06
2018	12	38	27	34	39	21	14	10	1	2	3	201	6.73
2019	5	51	59	39	37	17	11	7	5	4	4	239	8
Total	119	658	714	459	410	276	172	76	40	18	43	2985	100
%	3.99	22	23.91	15.4	13.7	9.2	5.76	2.55	1.34	0.6	1.44	100	

From the table 6 shows the authorship pattern of BU. The authors of BU published 2985 papers which is indexed in WoS database shows that they preferred to publish contributed by three authors (23.91%) followed by two authors (22%), four authors (15.4%), six authors (9.2%), seven authors (5.76%) and one author (3.99%) and so on. This pattern shows that authors of BU published their paper with the group of authors rather than single. There are 14 no. of titles where the single paper is contributed by more than 100 authors. The title “The compass experiment at CERN” has been contributed by 319 authors published

in “ Nuclear instruments & methods in physics research section A-accelerators spectrometers detectors in the year 2007.

Table 7 Authorship Pattern of Papers Published Kalyani University

Year	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Ten>	Total	%
2000	1	22	19	9	2							53	1.72
2001	4	29	10	9	4	2						58	1.89
2002	3	36	29	13	6	2						89	2.9
2003	12	25	28	10	7	6	1	1			1	91	2.96
2004	2	38	30	7	4	2	2					85	2.77
2005	1	25	37	11	6	2	6	1			1	90	2.93
2006	4	38	27	22	10	4	3	1		1	2	112	3.64
2007	5	21	42	23	10	5	3	2	3	1	1	116	3.77
2008	4	45	42	22	14	4	4	3	1	2	2	143	4.65
2009	5	42	49	32	16	7	6	2	1	1		161	5.24
2010	4	27	61	32	20	16	7	3			3	173	5.63
2011	5	52	37	31	13	15	5	4	5	3	2	172	5.6
2012	5	29	52	41	17	11	4	5	1	2	2	169	5.5
2013	3	54	57	34	30	26	19	5	3	1	2	234	7.61
2014	1	44	61	48	21	20	22	11	4	2	2	236	7.68
2015	4	47	46	50	21	14	9	4	2		1	198	6.44
2016	3	43	47	39	31	24	13	6	5	2		213	6.93
2017	1	59	47	35	28	18	17	4	5	1	5	220	7.16
2018	8	37	41	38	30	29	13	6	9	2	2	215	6.99
2019	5	54	41	44	39	28	10	9	6	6	4	246	8
Total	80	767	803	550	329	235	144	67	45	24	30	3074	100
%	2.6	24.95	26.12	17.89	10.7	7.64	4.68	2.18	1.46	0.78	0.98	100	

Table 7 Shows the authorship pattern of KU. KU authors also preferred to publish their papers contributed by three authors (26.12%), two authors (24.95%), four authors (17.89%), five authors (10.7%). The papers published by a single author is only 2.6%. The title “ fungal diversity notes 491-602 : taxonomic and phylogenetic contribution to fungal taxa” has contributed by highest numbers of authors i.e. 125 published in “Fungal Diversity journal” in the year 2017

From the above it is seen that authorship patterns show almost the same nature for both the universities BU and KU, and have a tendency to publish their research paper in multi-authored rather than the single-authored.

Degree of Collaboration (DC):

Table 8 : Authorship Pattern with Degree of Collaboration Measures (DC)

	Number of publication		**Percentage (%) of total publication**		**Nm+Ns**		**DC**	
	BU	**KU**	**BU**	**KU**	**BU**	**KU**	**BU**	**KU**
Total number of Single/Multi-Authored Publications	2985	3074	100	100				
Number of Co-Authored Publication (NM)	2866	2994			2985	3074	0.96	0.97
Number of Single-Authored Publication (NS)	119	80	3.98	2.60				
Number of two-Authored Publication	658	767	22.04	25.05	777	847	0.84	0.90
Number of three-Authored Publication	714	803	23.91	26.23	833	883	0.85	0.90
Number of Four-Authored Publication	459	550	15.37	17.96	578	630	0.79	0.87
Number of Five-Authored Publication	410	329	13.73	10.74	529	409	0.77	0.80
Number of Six-Authored Publication	276	235	9.24	7.67	395	315	0.69	0.74
Number of Seven-Authored Publication	172	144	5.76	4.70	291	224	0.59	0.64
Number of Eight-Authored Publication	76	67	2.54	2.18	195	147	0.38	0.45
Number of Nine-Authored Publication	40	45	1.34	1.47	159	125	0.25	0.36
Number of Ten Authored Publication	18	24	0.60	0.78	137	104	0.13	0.23
Number of Eleven and above-Authored Publication	43	30	1.44	0.98	162	110	0.26	0.27

The formula suggested by Subramanyam (1983) has been used to find the degree of collaboration (DC) of BU and KU

DC= Nm/Nm+Ns

Where Nm = Number of multi-authored papers

Ns = Number of single authored papers

Table 8 shows that the value of DC of BU is lowest among ten authored which is 0.13 and highest among three authored i.e 0.85 followed by two authored i.e. 0.84 and four authored i.e 0.79. The same patterns show for the DC of KU. The lowest value of DC is found among ten authored publications (0.23) and highest found among three authors (0.909) followed by two authored publications (0.905), four authored publications (0.87) and so on. Both the universities have shown the same trend towards multi- authorship papers.

Collaboration with other Countries:

Table 9: Geographical Distribution of Publications

Collaborating countries with BU			**Collaborating countries with KU**			**Rank**
Country	**Records**	**% of 2981**	**Country**	**Records**	**% of 3074**	
USA	86	2.88	USA	128	4.16	1
Taiwan	85	2.84	Germany	97	3.15	2
Spain	74	2.47	France	43	1.39	3
France	55	1.84	England	37	1.20	4
Italy	48	1.60	Taiwan	34	1.10	5
Germany	40	1.34	Sweden	33	1.07	6
Japan	39	1.30	Spain	30	0.97	7
Russia	34	1.13	Australia	27	0.87	8
Malaysia	33	1.10	South Korea	24	0.78	9
Poland	28	0.93	Japan	23	0.74	10

It is found from table 9 that both the universities have collaboration with the other countries researcher of the world for publishing their research papers. It is found that 6 countries are common out of top 10 countries in both the universities. The United States is at the top for both the universities with 86 records for BU and 128 for KU. In case of BU, Taiwan is at 2nd rank with 85 records followed by Spain with 74 records, France with 55 records, Italy with 48 and so. For KU, Germany ranked 2nd with 97 records followed by France with 43 records, England with 37 records, Taiwan with 34 records. It is also found that 943 papers (31.60%) of BU are in collaboration with other countries whereas for KU, 762 papers i.e. (24.79%) are collaboration with other countries.

It is better for any university where collaboration with other countries takes place as the exchange of ideas, knowledge and information is the backbone of any institution/universities.

Subject-wise Distribution of Publications:

Table 10: Subject-wise Number of Papers Produced

Research Areas of BU	**Records**	**% of 2985**	**Research Areas of KU**	**Records**	**% of 3074**	**Rank**
Chemistry	1186	39.73	Chemistry	1278	41.57	1
Physics	553	18.52	Physics	366	11.90	2
Engineering	253	8.47	Environmental	242	7.87	3

			Sciences Ecology			
Materials Science	228	7.63	Engineering	228	7.41	4
Mathematics	168	5.62	Biochemistry Molecular Biology	196	6.37	5
Optics	144	4.82	Materials Science	164	5.33	6
Science Technology Other Topics	141	4.72	Mathematics	145	4.71	7
Environmental Sciences Ecology	135	4.52	Science Technology Other Topics	127	4.13	8
Spectroscopy	116	3.88	Cell Biology	102	3.31	9
Crystallography	93	3.11	Plant Sciences	92	2.99	10
Biochemistry Molecular Biology	89	2.98	Toxicology	92	2.99	11
Mechanics	86	2.88	Computer Science	90	2.92	12
Plant Sciences	75	2.51	Biophysics	86	2.79	13
Nuclear Science Technology	68	2.27	Crystallography	84	2.73	14
Entomology	64	2.14	Biotechnology Applied Microbiology	71	2.31	15
Biotechnology Applied Microbiology	51	1.7	Genetics Heredity	68	2.21	16
Polymer Science	47	1.57	Optics	68	2.21	17
Computer Science	43	1.44	Life Sciences Biomedicine Other Topics	52	1.69	18
Pharmacology Pharmacy	43	1.44	Pharmacology Pharmacy	50	1.62	19
Metallurgy Metallurgical Engineering	40	1.34	Agriculture	47	1.52	20

Table 10 Shows research output of the two universities in different subject areas as defined by WoS. Top 20 subject areas where the authors from BU and KU prefer to publish their research papers. It is found from the table that authors from BU, chemistry ranked top with 1186 (39.73%) followed by physics with 553 (18.52%), engineering with 253 (8.47%), materials science with 228 (7.63%), mathematics with 168 (5.62%) and followed by other subject.

The highest publication for KU from the subject chemistry with 1278 (41.57%), physics with 366 (11.90%), Environmental Sciences Ecology with 242 (7.87), Engineering with 228 (7.41), Biochemistry Molecular Biology (196 (6.37), Materials Science with 164 (5.35) and followed by other subject area.

Institution-wise Distribution of Papers :

Table 11: Top 25 institutions/Universities collaborating with BU & KU

Affiliation with BU	**Records**	**Affiliation with KU**	**Records**
Department of Science Technology India	167(5.59)	University of Calcutta	143(4.65)
Indian Association for The Cultivation of Science IACS Jadavpur	140(4.69)	Jadavpur University	142(4.61)
Bhabha Atomic Research Center BARC	122(4.08)	Department of Science Technology India	140(4.55)
Jadavpur University	115(3.85)	Indian Association for The Cultivation Of Science IACS Jadavpur	103(3.35)
University of Calcutta	110(3.68)	Council Of Scientific Industrial Research CSIR India	78(2.53)
Council of Scientific Industrial Research CSIR India	93(3.11)	University of Burdwan	56(1.82)
Saha Institute of Nuclear Physics	87(2.91)	Indian Statistical Institute	56(1.69)
National Institute of Technology Durgapur	78(2.61)	Visva Bharati University	51(1.65)
Indian Institute of Technology System IIT System	73(2.44)	Indian Statistical Institute Kolkata	50(1.62)
Visva Bharati University	60(2.01)	Bidhan Chandra Agricultural University	49(1.59)
Kalyani University	56(1.87)	Indian Institute of Technology System IIT System	49(1.59)
National Tsing Hua University	41(1.37)	Indian Council of Agricultural Research ICAR	48(1.56)
Banaras Hindu University	33(1.10)	CSIR Indian Institute of Chemical Biology IICB	33(1.07)
UGC DAE Consortium for Scientific Research	32(1.07)	Indian Institute of Science Education Research IISER Kolkata	33(1.07)
University of Barcelona	32(1.07)	Kalyani Govt Engn Coll	29(0.94)
Govt Gen Degree Coll	27(0.90)	Saha Institute of Nuclear	27(0.87)

		Physics	
Indian Institute of Engineering Science Technology Shibpur IIEST	26(0.87)	Royal Institute of Technology	26(0.84)
University of Trieste	26(0.87)	Aliah Univ	25(0.81)
Fac Quim	25(0.83)	Shibpur Dinobundhoo Inst Coll	25(0.81)
Vidyasagar University	25(0.83)	Tezpur University	25(0.81)
Centre National De La Recherche Scientifique CNRS	24(0.80)	UGC DAE Consortium for Scientific Research	21(0.68)
Universiti Sains Malaysia	24(0.80)	Helmholtz Association	19(0.61)
Russian Academy of Sciences	23(0.77)	Presidency University Kolkata	19(0.61)
Durgapur Govt Coll	22(0.73)	Boiron Lab	18(0.58)
Academia Sinica Taiwan	21(0.70)	Krishnagar Govt Coll	18(0.58)

The contributors from BU and KU publish their research work with many institutions/universities of India as well other foreign countries. The list of top 25 institutions collaborating with BU and KU for the period 2000-19 is on the table 11 It is clear from the table that BU has collaborated papers with DST (167 papers), Jadavpur University (115 papers), University of Calcutta (110 papers), CSIR India (93 papers), Saha Institute of Nuclear Physics (87 papers).

It has been noticed that with top 25 institutions, ten are from West Bengal, eight from other countries and rest from other states of India.

KU has collaborated papers with the University of Calcutta (143 papers), Jadavpur University (142 papers, CSIR (78papers), university of Burdwan (56papers). In case of KU, 14 institutions/universities are from West Bengal, only three from other countries and rest are from other states of India.

Conclusion:

The present study mainly highlights the quantitative as well qualitative analysis of University of Burdwan (BU) and University of Kalyani (KU) for the period 2000-2019. The major finding of the study showed that BU published 2985 papers and KU published 3074 papers. The highest numbers of papers published by the contributors of BU in the year 2015 with 242 papers and KU in the year 2019 with 246 papers. The papers published from BU and KU received 41405 and 40895 citations. The paper also reveals that both the universities have almost the same nature of citation distribution among papers and have a tendency to publish the paper in multi-authored rather than solo publication. The USA is at top collaborating country for both the universities and journal article, proceeding papers and review are the most favorite mode of communication. The most favorite subjects for both the universities are chemistry, physics, engineering, materials science and mathematics.

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